Terms of Reference

Mars Sample Return Science Planning Group-2 (MSPG-2)

Introduction

Following several years of discussions, in April 2018 NASA and ESA signed a Joint Statement of Intent regarding Mars Sample Return (MSR), documenting their wish to pursue joint planning for a partnership to transport some or all of the samples to be acquired by the Mars 2020 sample-collecting rover to Earth. A fundamental premise of the partnership is that competed and selected scientists would equitably share access to the samples for collective scientific benefits and discoveries, as outlined in the NASA-ESA Joint Statement of Intent on MSR Science Benefits signed in July 2019. As one component of that planning, the MSR Science Planning Group (MSPG) was jointly chartered by NASA and ESA in late 2018 to develop 1) several key technical inputs to MSR science planning, by means of two workshops, and 2) a *Framework for Mars Returned Sample Science Management*. This planning material was delivered in October 2019 (https://mepag.jpl.nasa.gov/reports.cfm?expand=mspg), and supported the decision process at ESA with the 2019 November Council meeting at ministerial level (Space19+) and the NASA annual budgeting process (President's Budget FY2021). Both ESA and NASA have allocated substantial budgets to support further development of an MSR partnership.

Given the extensive work done by the MSPG, under the leadership of NASA and ESA representatives, and the feedback associated with the budgetary processes described above, it is now time to follow up and 1) develop the MSR Science Management Plan, using the guidelines in the "Framework" document, 2) address the highest priority open technical planning questions identified in the 2019 MSPG workshop reports, and 3) delineate the options and decision points for managing samples returned from Mars, from landing on Earth through analyses in the SRF and other potential facilities. The MSPG-2 will recommend requirements intended to maximize the science return of the sample collection. These follow-up planning activities specifically need to incorporate Curation and Planetary Protection.

Assumptions

1. The scientific objectives of MSR are comprehensively described by iMOST (2019).
2. Facility plans include the following:
    a. A biological containment and curation facility equivalent to a Bio-Safety Level 4 (BSL-4) Sample Receiving Facility (SRF) in the U.S. This facility will be responsible for the initial receipt of all returned flight hardware, including the samples. Within the SRF the Earth Entry System (EES) will be opened, and the samples extracted. This primary SRF will provide sample containment until such time as the samples are transferred (under containment) to another equivalently rated facility or are deemed safe for use in laboratories without containment. Scenarios involving a second containment facility in Europe may be under consideration by the MSR campaign partners, but it is not necessary to specify an assumption in this area for the purpose of this ToR.

   b. In addition to the biological containment and curation in the SRF, curation facility(s) without containment may exist in the U.S. or in Europe for samples determined to be safe. Knowledge of the final locations of curation facilities is not relevant/necessary for the purpose of the activities described in this ToR.
   c. Scientists from around the world will desire access to samples in containment and eventually, if safe, access to samples transferred out of containment for analysis in their own laboratories.
3. The decision on where to locate the U.S. SRF, and as appropriate a potential European facility, will be determined at a later time.
4. Delineating specific laboratory research or instrumentation will not be part of this activity, although the scope of the needed measurements will be.
5. The framework established by MSPG (*A Framework for Mars Returned Sample Science Management*), will serve as the foundation for the Science Management Plan. The Framework document considers and incorporates prior work, specifically including the important antecedent work that was completed by iMARS-2 and iMOST.
6. Personnel who will have worked on MSPG-2 will be eligible to work on later aspects of MSR.

Statement of Task

MSPG-2 will address MSR science and curation planning questions for which the specifics and the schedule will determined by the NASA and ESA leads. These questions may include, but not be limited to, the following topics:

1. Inputs to the "Science Management Plan*." The MSPG-2 is expected either to adopt the MSPG recommendations, or to propose suitable alternatives, regarding science management planning issues. The scope of this task could include, but not necessarily be limited to, the following:
   A. Amplify the planning descriptions of the bodies & processes described in the "Framework" document, Section 4.
   B. Define the interfaces, organizational relationships, and communication pathways between science, curation, Mars 2020, facilities planners, and planetary protection.
2. Technical issues related to the science of MSR and how the implementation of MSR impacts the potential scientific usefulness of the samples. The technical issues considered may include, but are not limited to:
   A. Sample sterilization, including consideration of the effects of sterilization on the science as well as implications for the SRF.
   B. Use of penetrative imaging (synchrotron imaging or CT scanning) on the sample tubes before they are opened.
   C. As needed, propose quantitative sample quality-related requirements for the transport/handling of the samples during the MSR flight campaign.
3. Develop approaches and a working list of high-level requirements for the SRF that can be used in cost estimation and budgeting. The requirements specifically need to represent the needs and interests of each of science, curation, and planetary protection. All proposed requirements need a justification statement.
4. A list of key decision points related to the Mars returned samples with inputs from science, curation, and planetary protection, and represent them on a master timeline.

Operating Procedures

These issues would be addressed by means of convening representatives from the scientific community, conducting workshops, and regular telecom and e-mail discussions. Emphasis is

placed on the responsibility of this group to represent the view of the international science community and other stakeholders of Mars Sample Return science output.

It is expected that MSPG-2 will begin its work as soon as possible after May 31, 2020. MSPG-2's leadership is asked to:

A. Identify and prioritize the specific tasks that need MSPG-2's attention.
B. Propose a realistic schedule for the delivery of interim results as well as the delivery of final products for each task assigned. Assume that interim briefing(s) will be supported by a PPT-formatted presentation file(s), and that the final results will be delivered as one or more text-formatted reports with accompanying PPT presentation file(s).
C. Formulate strategies to maintain engagement with the science research community during this early planning period.

MSPG-2 is expected to document the results of all of the topics that it takes up in the form of written reports.

Logistics

- Co-chairs will consist of NASA and ESA representatives.
- The implementation support will be provided by the "MSR Office" at JPL, and sponsorship by NASA and ESA.
- For reasons of both cost and time, it is expected that most of the MSPG-2's work will be carried out using e-mail and teleconferences. However, it is hoped that two face-to-face meetings will be scheduled in 2020. If circumstances permit, the team will be encouraged to take advantage of opportunities to meet when most/all of the team will be in the same place at the same time (e.g. at major conferences).
- As needed, task groups can be commissioned to address specific issues within the scope of the MSPG-2
- MSPG-2 is expected to complete its work by a draft date of April 30, 2021.

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Martian Programme Group Leader (acting)
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*The Science Management Plan is an MSR Campaign document that encompasses the science requirements and management for handling, containment, and distribution of the returned samples.